now a morning star, and that after sunset they would see the difference; in fact, when it became dark a tail, 22° in length, was seen stretching across Capricornus, the head being in Sagittarius. Tycho was not the first to see it; it had been seen on November 1 in Peru, and on November 2 in London. His observations were, however, much the most accurate that were made; he measured its distance from neighbouring stars with a sextant, the arms of which were 4 ft. long, afterwards observing the places of the stars with his fundamental instruments. He followed the comet until January 26, when it was in Pegasus. He examined its diurnal parallax both by his own observations at different hours of the night and by comparing his places with those observed at Prague by Hagecius. He was thus enabled to say definitely that the comet was considerably more distant than the moon, and consequently the Aristotelian doctrine that comets are simply atmospheric meteors was completely overthrown.

Tycho's endeavours to determine the true orbit were not very successful. He was still under the influence of the old prejudice that all the heavenly movements must necessarily be in circles, and the orbit he assigned to the comet was a circular one, with the sun in the centre, and a radius about six-sevenths of the distance from sun to earth, giving an angle of elongation of 60°. Tycho was unable, however, to represent the observations by uniform motion in this circle. He deduced correctly that the heliocentric motion was in the opposite direction to that of the planets, and supposed that comets were short-lived bodies, the movements of which might be subject to greater irregularities than those of the planets. The inclination of the orbit to the ecliptic he gave as 29¼°, about one-third of its true value; it is interesting to quote the parabolic orbit (based on Tycho's own observations) for comparison with his: Perihelion passage, October 27; long. of asc. node, 25°; arc from node to perihelion, 256°; inclination, 105°; perihelion distance, 0·177. It is not surprising to read that many of Tycho's contemporaries did not perceive the force of his proof that the comet was much more distant than the moon, and continued to assert the Aristotelian doctrine. Among them was a Scotsman named Craig, with whom Tycho had a long controversy.

The volume also describes Tycho's system of the universe, and his reasons for adopting it. He thought the earth was too heavy and sluggish a body to be capable of rapid motion, and he also thought the absence of a lateral drift in falling bodies disproved the theory of its rotation. He therefore supposed it to be at rest in the centre of the universe, and that the sun and moon revolved round it, while the planets revolved round the sun. The fixed stars were imagined to be attached to a transparent sphere a short distance beyond the orbit of Saturn; at least, this is suggested by his diagram, which pictures them as all lying between two closely adjacent concentric spheres, and by his supposition that they rotate *en bloc* about the earth in twenty-four sidereal hours. He thought the absence of annual parallax in the stars afforded a decisive proof of the earth's immobility, and the idea of the immense void of space between the orbit of Saturn and the stars, which would be required on the hypothesis of the earth's motion, was repugnant to his mind. Also he considered that he had determined the apparent diameters of the brighter stars to be 2′ or 3′, and he saw that such diameters, in view of the absence of annual parallax, implied dimensions for these orbs that he regarded as inconceivably great. It must be admitted that before the invention of the telescope and the discovery of the laws of motion and gravitation there was a good deal to be said for his point of view, and he did not permit his theory to bias his observations, which enabled Kepler to deduce the true planetary system.

These sumptuous volumes, though printed at Copenhagen, are edited by Dr. Dreyer, who now resides at Oxford. They enable us to picture the astronomical conceptions of Tycho's age, and the enormous progress that has been made in the last three centuries.

A. C. D. Crommelin.

OUR BOOKSHELF.

Natural Science and the Classical System in Education. Essays New and Old. Edited for the Committee on the Neglect of Science by Sir Ray Lankester. Pp. ix + 268. (London: William Heinemann, 1918.) Price 2*s.* 6*d.* net.

Four of this admirable series of nine essays were written fifty years ago, but they are wonderfully fresh and stimulating even now. These include a masterly history of classical education by Charles Stuart Parker, and essays "On the Education of the Reasoning Faculties," by William Johnson, the brilliant Eton tutor of the later nineteenth century; "On Teaching by Means of Grammar," by E. E. Bowen, of Harrow, of "Forty Years On" renown; and "On the Present Social Results of Classical Education," by Lord Houghton, father of the present Marquess of Crewe.

The views of Mr. H. G. Wells on modern education, as set out in an address to the members of the British Science Guild, are reprinted in this volume; and readers of the *Fortnightly Review* will recognise the same author's "Case against the Classical Languages," written in reply to Mr. Livingstone's "Defence of Classical Education."

The position of science in educational reconstruction is discussed by Mr. Sanderson, of Oundle School, in an essay which will probably meet with criticism from some educationists. The Master of Balliol has treated the same question in its wider aspects. Sir Ray Lankester concludes with a chapter on "The Aim of Education," throughout which runs the spirit of Huxley.

Nowhere is there any suggestion of antagonism towards the study of the classics; indeed, all scientific workers realise to the full the value of classics as a branch of education. The monopoly of the classical system in education, however, is a different matter, and this dominating factor is assailed on all sides.

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Horizons: At Dawn and at Dusk. Poems by **Colin Tolly.** Pp. ix+82. (London: Hodder and Stoughton, 1918.) Price 3*s.* 6*d.* net.

MR. TOLLY is clearly a scholar who has been thrown, like so many others, into the brutalities of war, and who heartens himself by writing verses that recall the happier years. But, though he has studied the ancient classics, and also zoology, his manner is not that of a poet, or even of a teacher, seeking in the concise forms of verse the expression of cumulative research. Why, for example, and for what mechanical reason, did the dead Adonis sail "to sea, on springs"? Does the sun "shine" a beam? And will the general reader, who has still so much to learn about ancestral forms of life, really gather anything from the condensed text-book terminology of pp. 49–60? We might, indeed, be pleasantly surprised to "hear the tune" that the Permian reptiles "sang at sundown . . . pregnant with speech and nightingales"; but we cannot believe that, by any process of selection, "Death . . . endowed with brains the victors" in the struggle for existence. The crowded stanzas on the development of religions are not more satisfactory. It is unfair to suggest what Swinburne or Flecker might have made of them; but, even between Olympos and Salonika, Mr. Tolly has caught only the spray of the high and rising wave of war-time inspiration.

G. A. J. C.

Journal of the Institute of Metals. Vol. xix. Pp. x+316. (London: Published by the Institute, 1918.) Price 21*s.* net.

THE latest volume of this useful journal contains several papers of interest. Prof. Carpenter, in addition to his presidential address, in which he deals with the relations between scientific investigation and training and technical practice, contributes, with Miss Elam, a paper on the cause of unsoundness in bronze castings. The subject is a difficult one, and the principal conclusion, confirmed by the experience of others who took part in the discussion, is that the most important factor in ensuring soundness is the proper control of the pouring temperature. The equilibrium between a molten alloy and the gases dissolved in it still remains somewhat mysterious. Die-casting, especially of alloys of high melting-point, has received little attention in technical journals, although it is widely and successfully used in practice, and the paper by Messrs. Rix and Whitaker is the more welcome on that account. By using an aluminium bronze containing iron, excellent results have been obtained with complicated castings. The discussion turns largely on the behaviour of the dies. Aluminium bronze is also studied from the point of view of the hardness of alloys by Mr. Greenwood, and other matters dealt with are the determination of the grain size of metals and the annealing of aluminium. The volume also includes abstracts of metallurgical papers from all sources.

LETTERS TO THE EDITOR.

[The Editor does not hold himself responsible for opinions expressed by his correspondents. Neither can he undertake to return, or to correspond with the writers of, rejected manuscripts intended for this or any other part of NATURE. *No notice is taken of anonymous communications.]*

Science and the Civil Service.

IN the article on the above subject in NATURE of August 8, the unsatisfactory method of selecting candidates for Civil Service appointments is very justly emphasised. I desire to make the following suggestion, which will obviate the system of patronage and to a great extent that of competitive examination, both of which suffer from serious inherent defects which need not be discussed.

My suggestion is that each university of the United Kingdom be granted the right to nominate each year one or more candidates (according to the number of vacancies) from its most promising honours graduates. A further selection from among the nominees might, if necessary, be made by some form of oral or written examination.

It is improbable that any university would abuse this privilege and thereby discredit itself by nominating a student who is likely to prove a failure. The experience in the selection of the 1851 Exhibition scholars is a sufficient guarantee of the highly satisfactory results of such a system.

The most promising arts and science men in the country would thus become available for Government appointments, and it is to be hoped that with this choice the science departments of the State will in future be administered by men whose training has not been exclusively classical.

J. B. COHEN.

THE ROYAL INSTITUTION: A RETROSPECT.

A RECENT issue of the Proceedings of the Royal Institution contains a reprint of a lecture delivered in its theatre on March 3, 1810, by the then professor of chemistry, "H. Davy, Esq., Sec., R.S." This lecture, as its title-page informs us, was originally published by desire of the managers; it is now reproduced at the suggestion of the Fullerian professor of chemistry. It is entitled "A Lecture on the Plan which it is Proposed to Adopt for Improving the Royal Institution and Rendering it Permanent." To understand the significance of this wording it is necessary to recall some circumstances connected with the early history of the institution.

As conceived by its founder, Benjamin Thompson, a Royalist American who had been created a Count of the Holy Roman Empire by the Elector Palatine of Bavaria, it was intended to be part of an establishment for the benefit of the poor. In 1796 Rumford, who was a practical philanthropist on a pretty broad gauge, and an early worker in what is now styled "domestic science," put forth a

> proposal for forming in London by private subscription an establishment for feeding the poor and giving them useful employment, and also for furnishing food at a cheap rate to others who may stand in need of such assistance, connected with an institution for intro-

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